Performance Measurement for Software Organizations

DFAS Software Symposiur

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Sponsored by the US Department of Defense

Bring Me A Rock!!!!!!!

"We need a measurement program. Get one started."

"We don't have time to define our goals. We have products to deliver."

"We collect a lot of data. We just never seem to use it."

Outline

Some questions about performance measurement:

- **What is performance measurement?**

- **Who is the audience/consumer of performance information?**

- **How are the data for performance measurement produced?**

- **What do the results mean?**

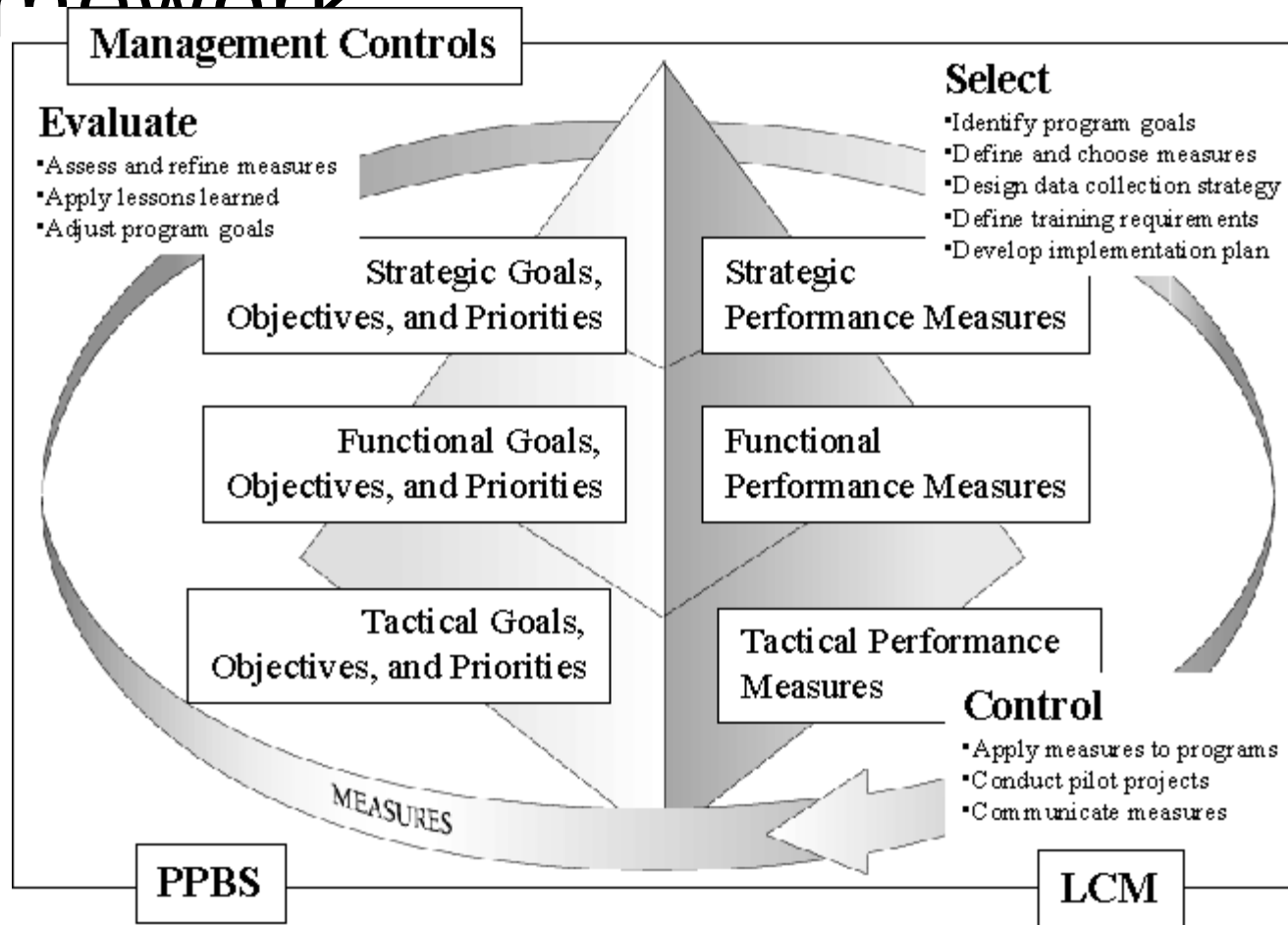**A process for defining performance measures**

What is IT Performance Measurement

Quantitative* characterization of an *organization's* accomplishment of some *aspect* of its *goals* with a focus on the *contribution of IT

- **quantitative - need something more discriminating than success/failure, yes/no**

- **organization - focus is on the organization or enterprise view, not a specific project or program**

- **aspect - performance is multidimensional, what to measure is not obvious**

- **goals - for measurement to be meaningful, we need a reference point for comparison and judgement**

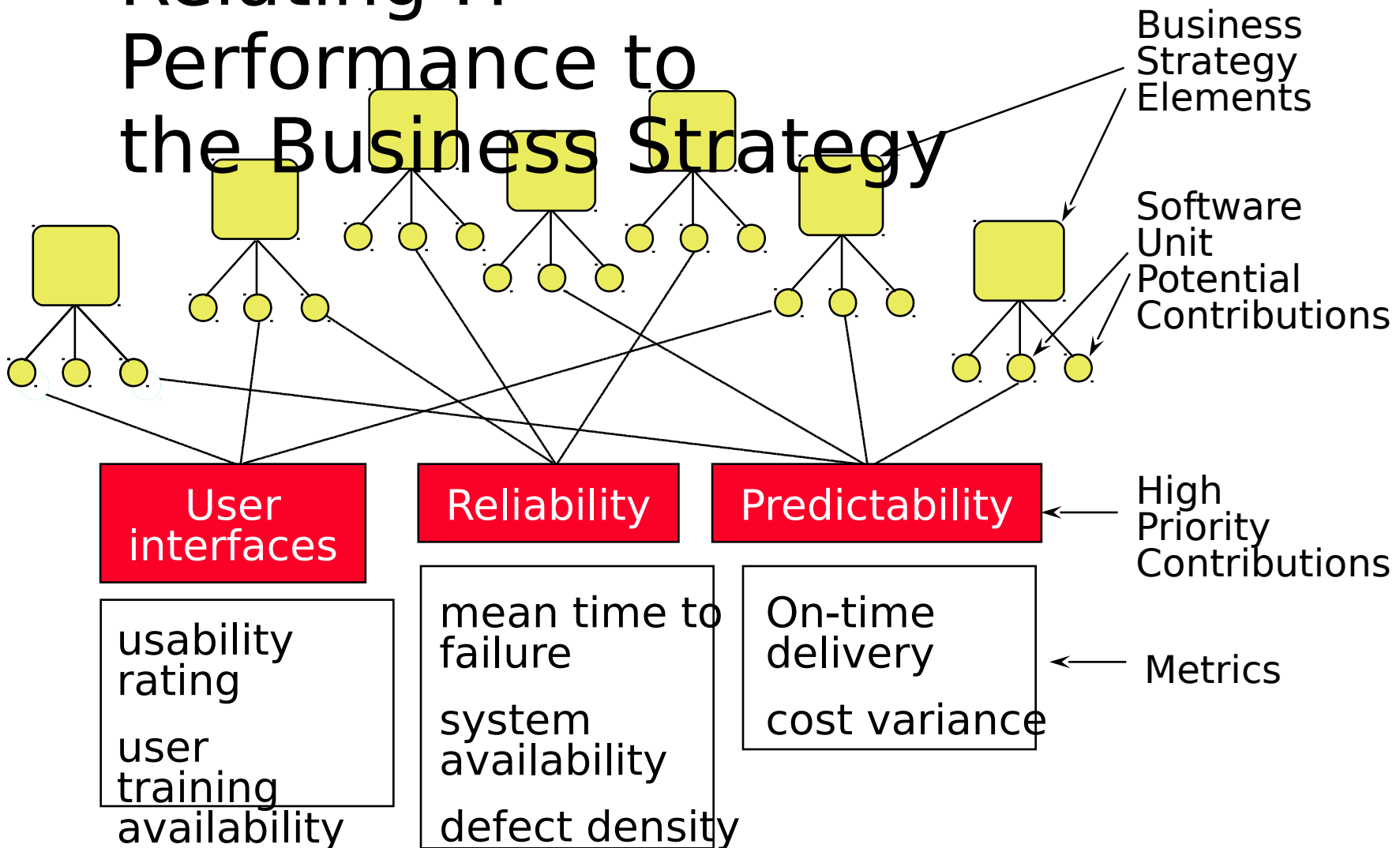- **contribution of IT - attribution of organizational performance to IT performance**

Performance Management Framework

Relating IT Performance to the Business Strategy

Business Strategy Elements

Software Unit Potential Contributions

User interfaces

Reliability

Predictability

High Priority Contributions

usability rating

user training availability

mean time to failure

system availability

defect density

On-time delivery

cost variance

Metrics

Who is the audience?

We all want the business to succeed, but do we all speak …

revenue

market share

Customer satisfaction
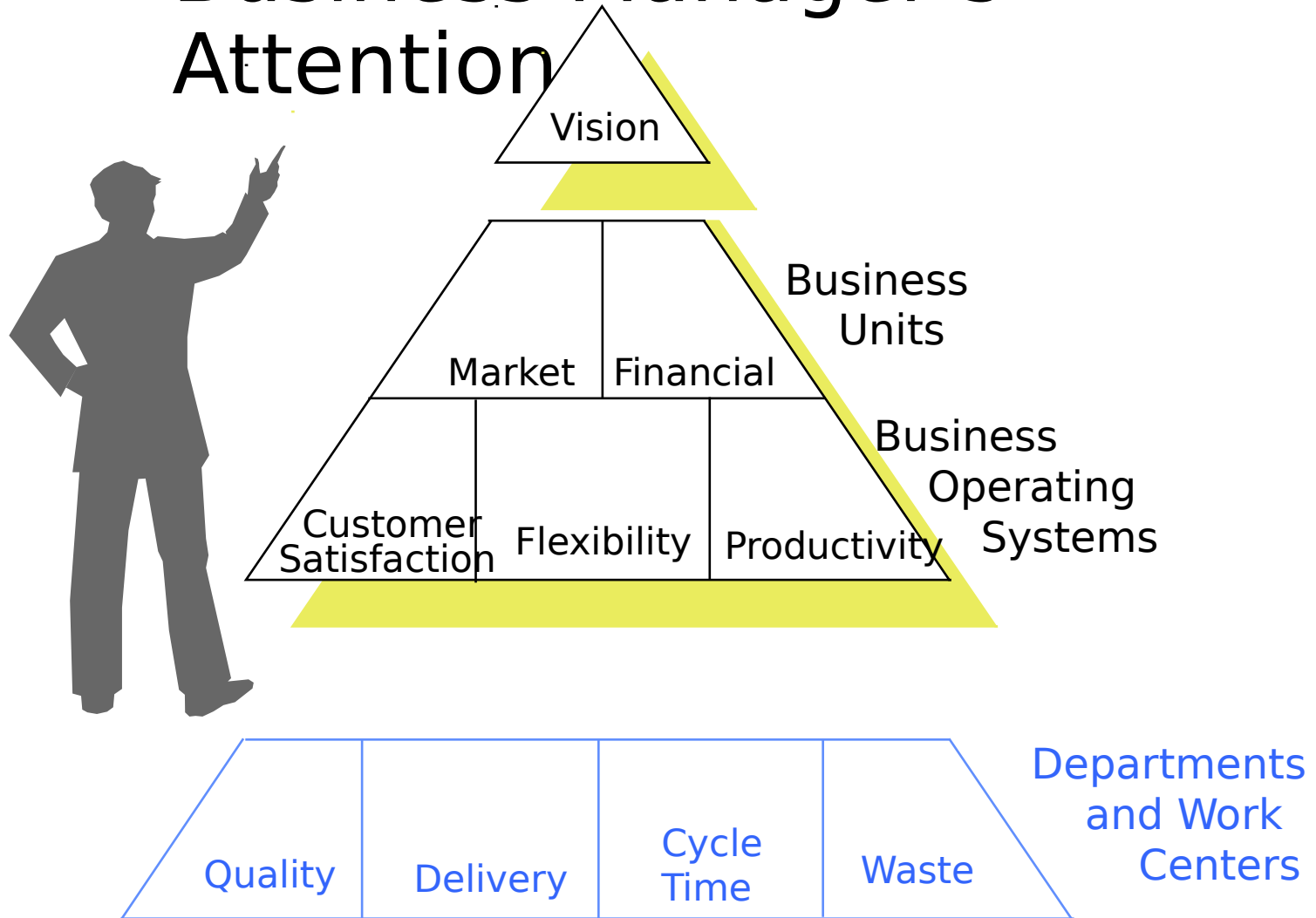
mean time to failure

inspections
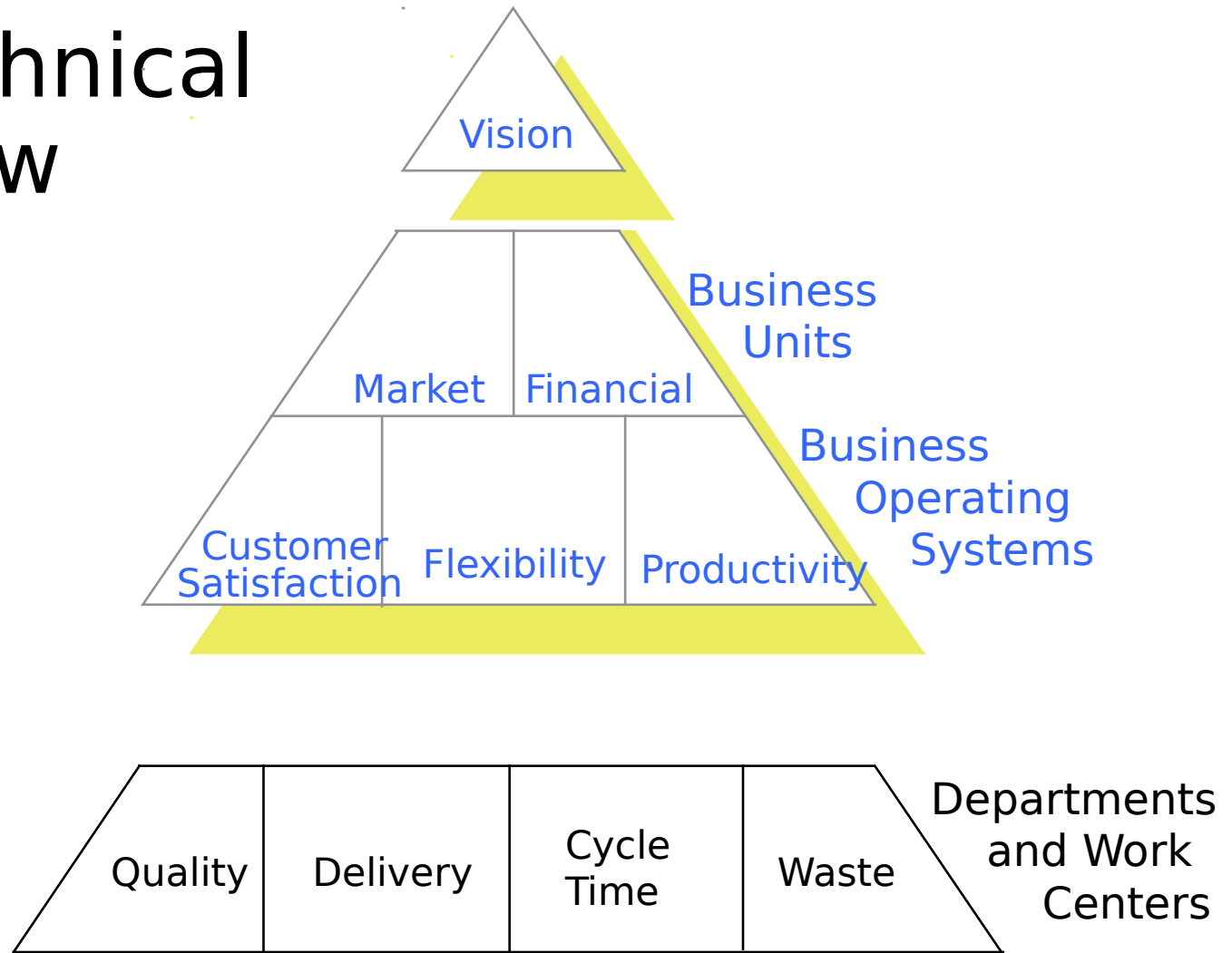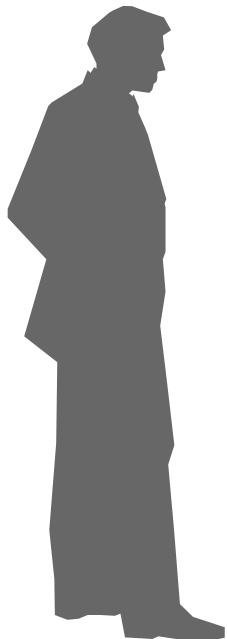
defect density

…the same language?

key process areas

Business Manager's Attention

Vision

Business Units

Market | Financial

Business Operating Systems

Customer Satisfaction | Flexibility | Productivity

Departments and Work Centers

Quality | Delivery | Cycle Time | Waste

Adapted from Cross & Lynch "Measure Up: Yardsticks for Continuous Improvement."

Technical View

Vision

Business Units

Market | Financial

Business Operating Systems

Customer Satisfaction | Flexibility | Productivity

| Quality | Delivery | Cycle Time | Waste |

Departments and Work Centers

The Audiences and Their Interests

Senior management - for strategic decisions

- **business managers**
- **IT managers**

Improvement team - to implement improvements and know how well they are doing
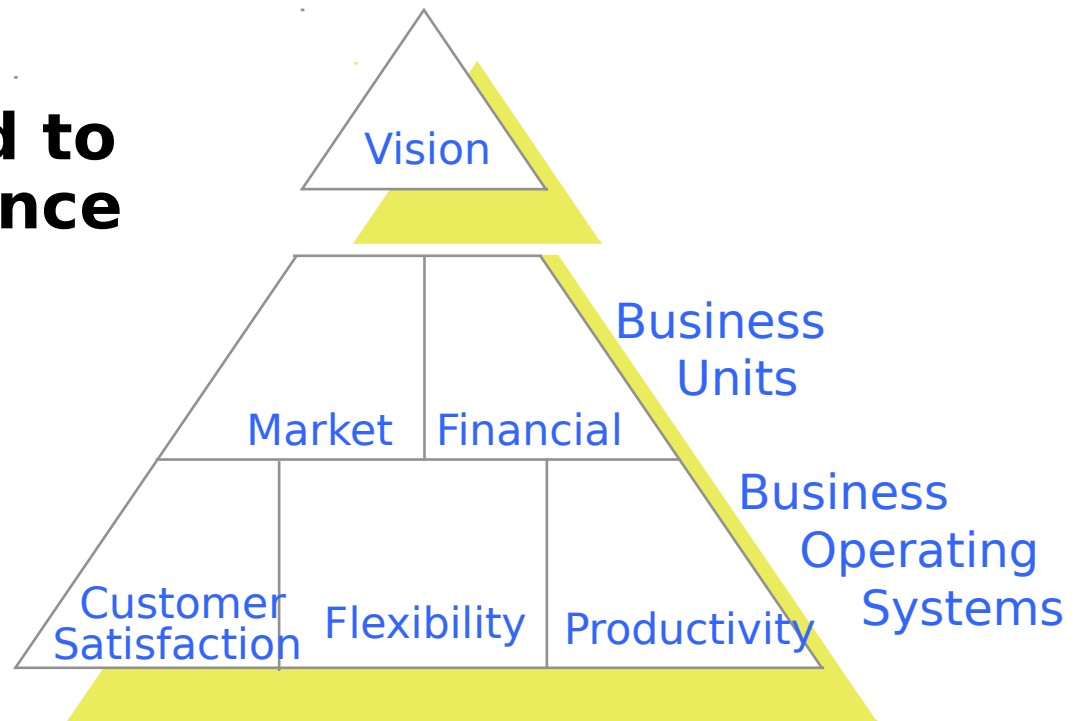
- **IPTs**
- **IT process action teams**

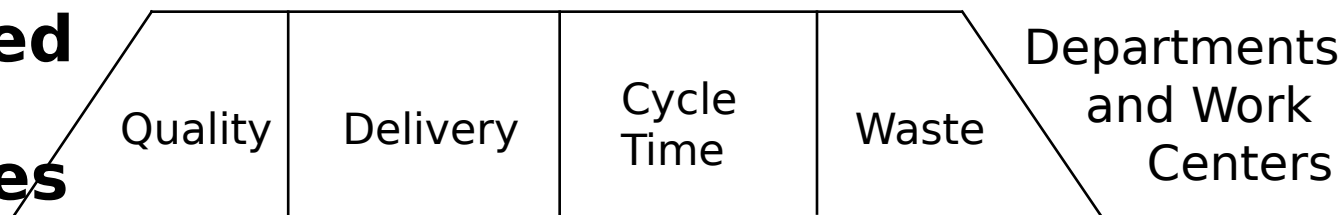**Customers - to evaluate suppliers and understand their capability**

How are the data produced?

Information used to assess performance and guide improvement

Vision

Business Units

Market | Financial

Business Operating Systems

Customer Satisfaction | Flexibility | Productivity

Data generated by work processes and

| Quality | Delivery | Cycle Time | Waste | Departments and Work Centers |

What do the results mean?

Possible Interpretations

- **Accomplished a goal - has the goal been met**

- **Progress towards a goal - are trends moving in the right direction according to schedule**

- **Impending threat - can signal risk of not meeting future goal**

- **Guidance for improvement - what should we look at as an opportunity for improvement**

- **Competitive position - ranking or performance relative to competitors**

It depends on the goal and strategy

A Process for Measuring the Performance…of Information Technology….

Follow an IT Results Chain

Use a Balanced Scorecard

Target Measures at Decision Making Tiers

Build a Measurement and Analysis Infrastructure

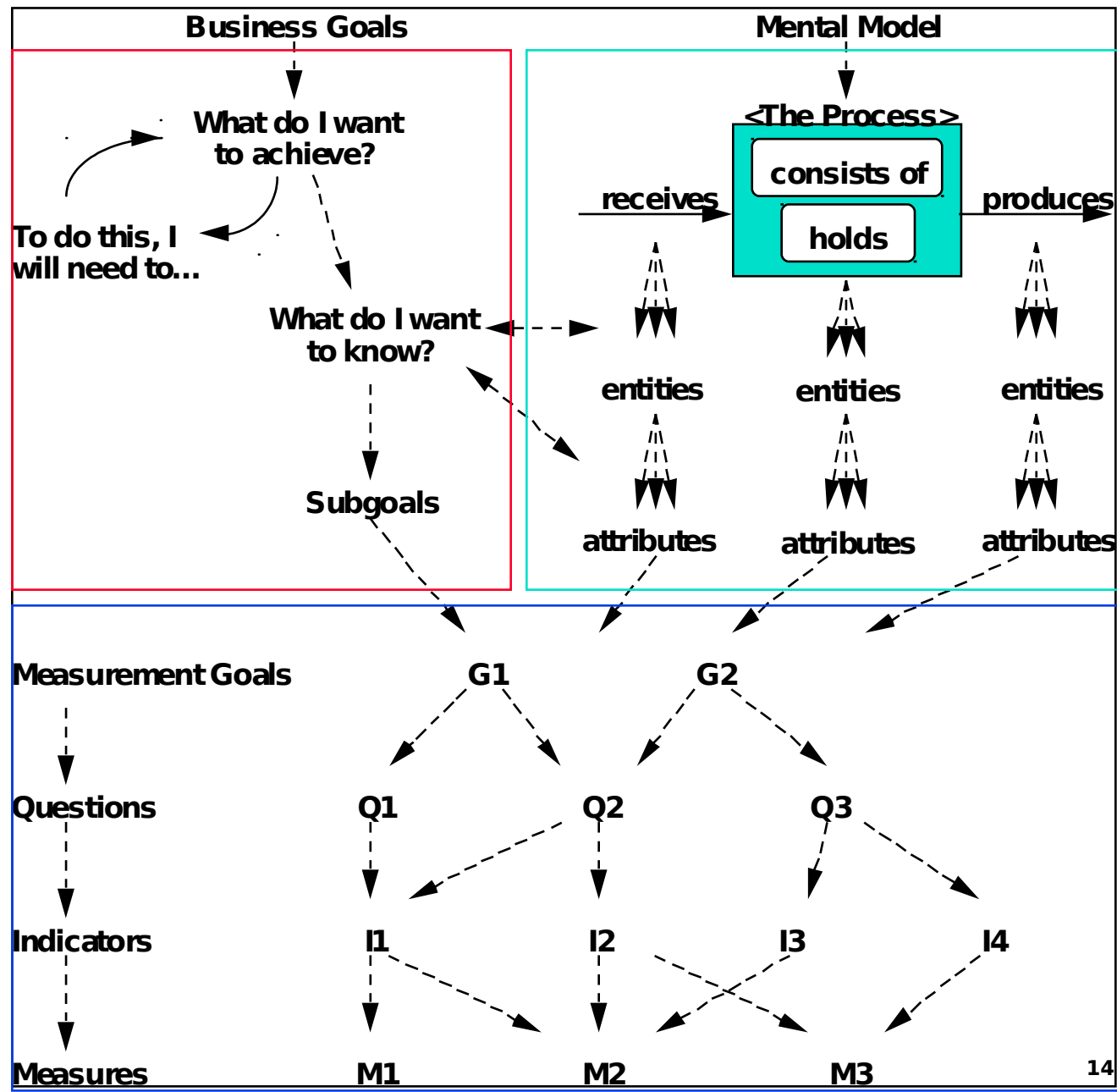**Strengthen IT Processes to Improve Mission Performance**

Source: "Executive Guide-Measuring performance and demonstrating results of information technology investments," US General Accounting Office, March 1998.

Business Goals define the Need

The Process provides the Opportunity

Alignment is the Key

Business Goals

What do I want to achieve?

To do this, I will need to...

What do I want to know?

Subgoals

Mental Model

<The Process>

consists of

holds

receives

produces

entities

entities

entities

attributes

attributes

attributes

Measurement Goals

G1

G2

Questions

Q1

Q2

Q3

Indicators

I1

I2

I3

I4

Measures

M1

M2

M3

14

A Balanced Perspective on Performance

Can improvement in one area be made without sacrificing another?

Financial
How do we look to shareholders?

Customer
How do customers see us?

A Balanced Perspective
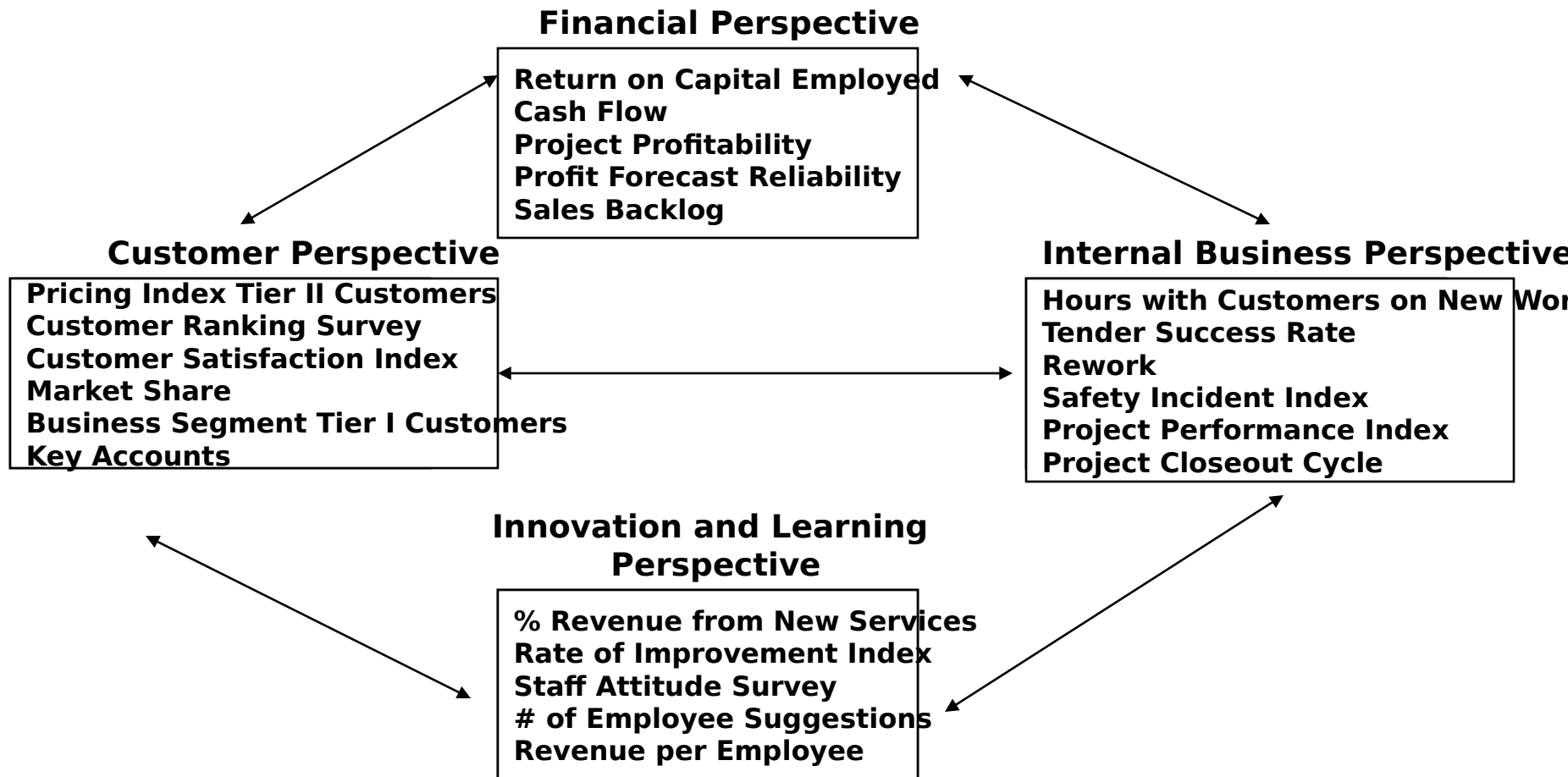
Internal Business
What must we excel at?

Innovation and Learning
Can we continue to improve and create value?

Watch out for masked trade-offs, unintended consequences

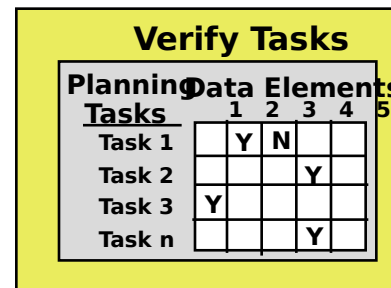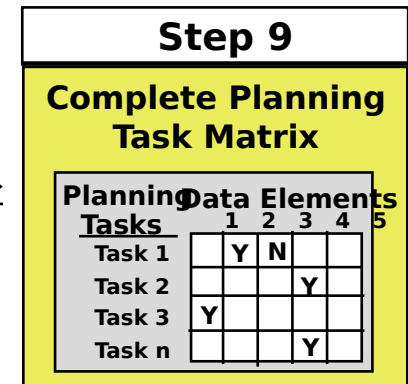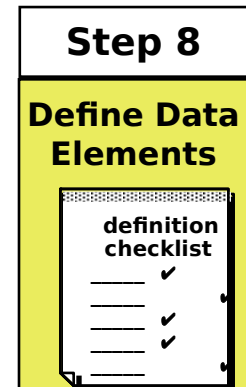See Kaplan and Norton, "The Balanced Scorecard - Measures that Drive Performance" Harvard Business Review, Jan/

A Balanced Scorecard Example

Financial Perspective

**Return on Capital Employed
Cash Flow
Project Profitability
Profit Forecast Reliability
Sales Backlog**

Customer Perspective

**Pricing Index Tier II Customers
Customer Ranking Survey
Customer Satisfaction Index
Market Share
Business Segment Tier I Customers
Key Accounts**

Internal Business Perspective

**Hours with Customers on New Work
Tender Success Rate
Rework
Safety Incident Index
Project Performance Index
Project Closeout Cycle**

**Innovation and Learning
Perspective**

**% Revenue from New Services
Rate of Improvement Index
Staff Attitude Survey
# of Employee Suggestions
Revenue per Employee**

Source: Kaplan and Norton, "Putting the Balanced Scorecard to Work" Harvard Business Review, Sept-Oct 1993

Goal-Driven Process Steps

Measurement Workshop

Post Workshop

Step 1	Step 2	Step 3
Identify your Business Goals	**Identify what do you want to learn or know about the goals.**	**Identify your Sub-goals**

Step 4	Step 5	Step 6
Questions, Entities, & Attributes	**Formalize Measurement Goals**	**Define Indicators**

Step 7
Identify Data Elements

Data Elements
Size
Defects

Avail	Source
+	QA
0	CM
-	?
0	Etc.
+	•
- -	•

Step 8
Define Data Elements

definition checklist
✔
✔
✔

Step 9
Complete Planning Task Matrix

Planning Tasks	Data Elements				
	1	2	3	4	5
Task 1	Y	N			
Task 2				Y	
Task 3	Y				
Task n				Y	

Step 10 Implementation

Verify Tasks

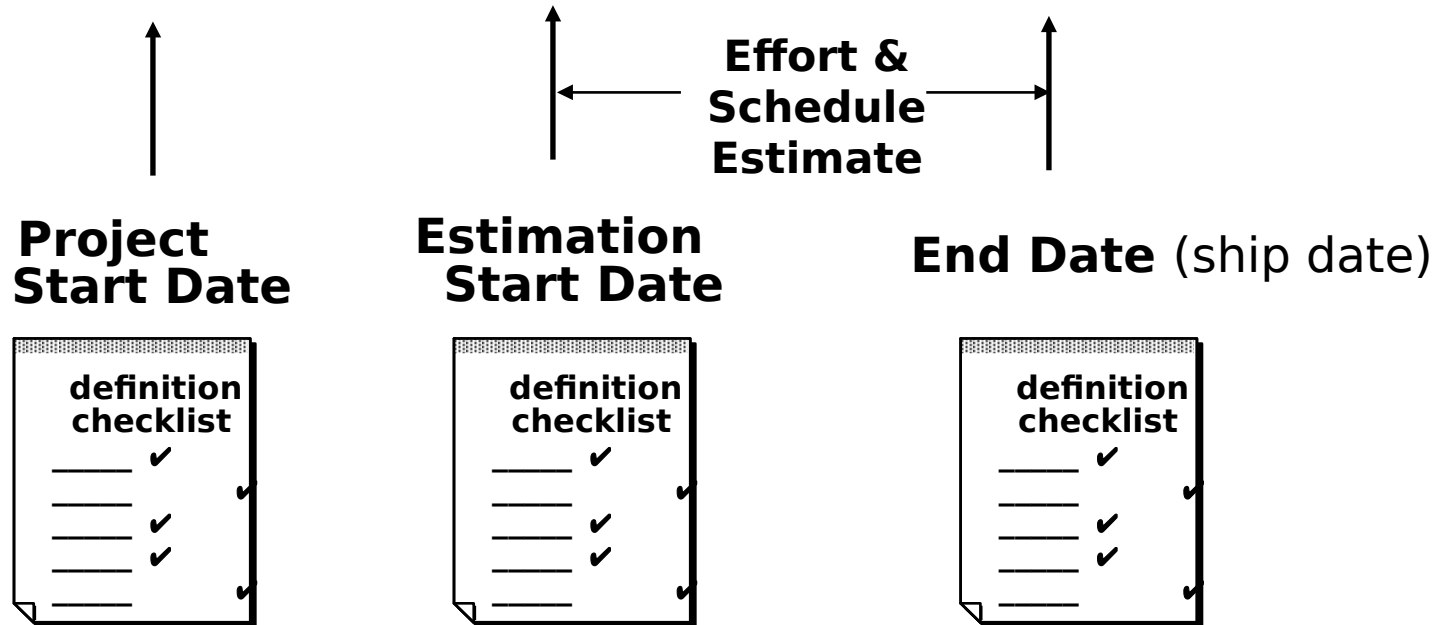| Planning Tasks	Data Elements				
	1	2	3	4	5
Task 1	Y	N			
Task 2				Y	
Task 3	Y				
Task n				Y	

Analysis & Diagnosis

Action Plans

Operational Definitions

Key dates - start and end times

Project Phases

Feasible Study	Alternative Analysis	Functional Specification	Design	Code & Unit Test	Integration Test	UAT	Deployment
Initiation		Definition	Design	Build	Verification		Implementation

Effort & Schedule Estimate

Project Start Date

Estimation Start Date

End Date (ship date)

definition checklist
_____ ✔
_____ ✔
_____ ✔

definition checklist
_____ ✔
_____ ✔
_____ ✔

definition checklist
_____ ✔
_____ ✔
_____ ✔

Characteristics of the

Mutually Exclusive

- **Measure different dimensions with each measure**

Exhaustive

- **<u>Outcomes</u>, Outputs, Inputs, Process**
- **Balanced Scorecard**

Valid

- **The measures logically relate to their corresponding indicator or use**

Reliable

- **The same performance would result in the same measurement**

Interval Scale

- **Need variability to distinguish performance levels**

Defining Performance Me

Document the why, what, who, when, where, and how

Measures

Defects
Cost of Quality
Schedule Predictability
Effort Predictability
Cycle Time
Maintenance Effort
Project Mix
Customer Satisfaction
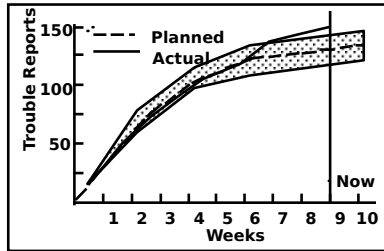
INDICATOR TEMPLATE

Objective ——————————

Questions ——————————

Visual Display

Trouble Reports / Planned / Actual / 150 / 100 / 50 / Now / 1 2 3 4 5 6 7 8 9 10 / Weeks

Input(s)

    Data Elements ——————————

    Responsibility ——————————
    for Reporting

       Form(s) ——————————

Algorithm ——————————

Assumptions ——————————

Interpretation ——————————

    X-reference ——————————

    Probing Questions ——————————

    Evolution ——————————

Criteria for Evaluating Performance Measures – 1

Are we measuring the right thing?

- **improvement in performance of mission**
- **improvement in performance of goals and objectives**
- **value added by IT organization**
- **ROI, costs, savings**

Based on strategy and objectives

- **not what's convenient and "lying around"**
- **relevant and important**

Source: National Academy of Public Administration, "Information Management Performance Measures," January, 1996

Criteria for Evaluating Performance Measures - 2

Do we have the right measures?

- **measures of results rather than inputs or outputs**
- **linked to specific and critical processes**
- **understood by their audience and users effective in prompting action**
- **credible and possible to communicate effectively**
- **accurate, reliable, valid, verifiable, cost-effective, timely**

Develop as a Set

- **don't rely on a single indicator**
- **will trade-offs in performance be detected?**

Criteria for Evaluating Performance Measures - 3

Are the measures used in the right way?

- **strategic planning**
- **guide prioritization of program initiatives**
- **resource allocation decisions**
- **day-to-day management**
- **communicate results to stakeholders**

Example: Process Improvement Goals

Internal Processes

- **increase productivity by a factor of 2 over 5 years**

- **reduce development time by 40% over 5 years**

- **improve quality by a factor of 5 over 5 year**

- **reduce maintenance effort by 40% over 5 years**

Customer Satisfaction

- **improve predictability to within 10% over 5 years**

Enterprise

Project Size:
- ▬ Small
- ▬ Medium
- ▬ Large

Cost of Quality:
- ▬ Rework
- ▬ Appraisal
- ▬ Prevention
- ▬ Performance

Schedule Predictability — Percent Deviation (1996–1997)

Effort Predictability — Percent Deviation (1996–1997)

Maintenance Effort — Percent of Tech. Staff-Hours / Open Trouble Reports
- Non-discretionary Maint. Effort
- Enhancement Effort
- Defect Corrections
- Open Trouble Reports
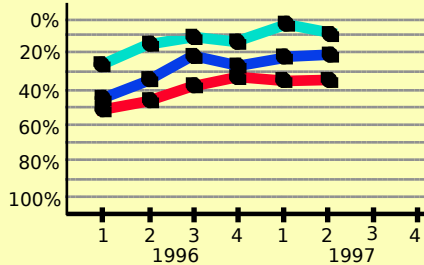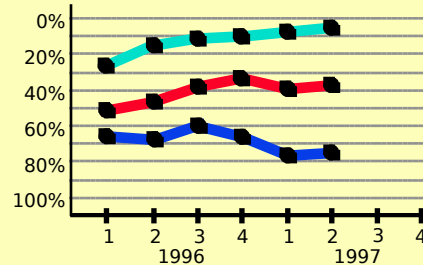
Cycle Time — Calendar Days per Size Unit
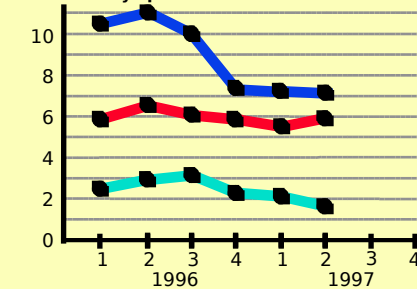
Quality — Defect Density at UAT / Number of High Priority Field Defects
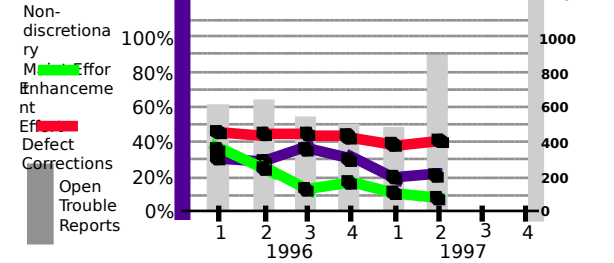
Customer Satisfaction — Satisfaction index
- Implemented Solution
- Working Relationship

COQ – Large Projects — Effort Hours per Size Unit
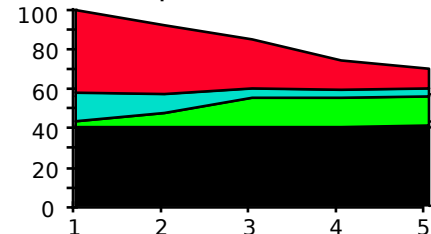
COQ – Medium Projects — Effort Hours per Size Unit
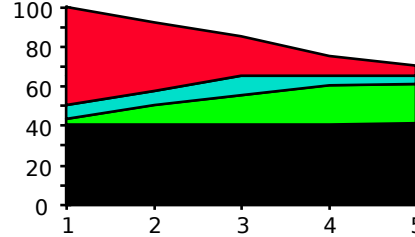
COQ – Small Projects — Effort Hours per Size Unit

Example Output

Schedule Predictability

The Objective is to understand the effectiveness the user acceptance test (UAT) was to be completed and the actual date when the UAT was completed along with the start date of coding of the project.
The Percentage Deviation in schedule for different categories is calculated as follows:

$$\text{Percent Deviation} = \frac{\text{Absolute value (Actual Ship date - Planned Ship date)}}{\text{Planned Ship date - Start date of coding}} * 100$$

A downward trend predicts improvement in the predictability and an upward prove its ability to predict schedules for completion of projects if we monitor this metric over a period of time.

Schedule Predictibility (Overall)
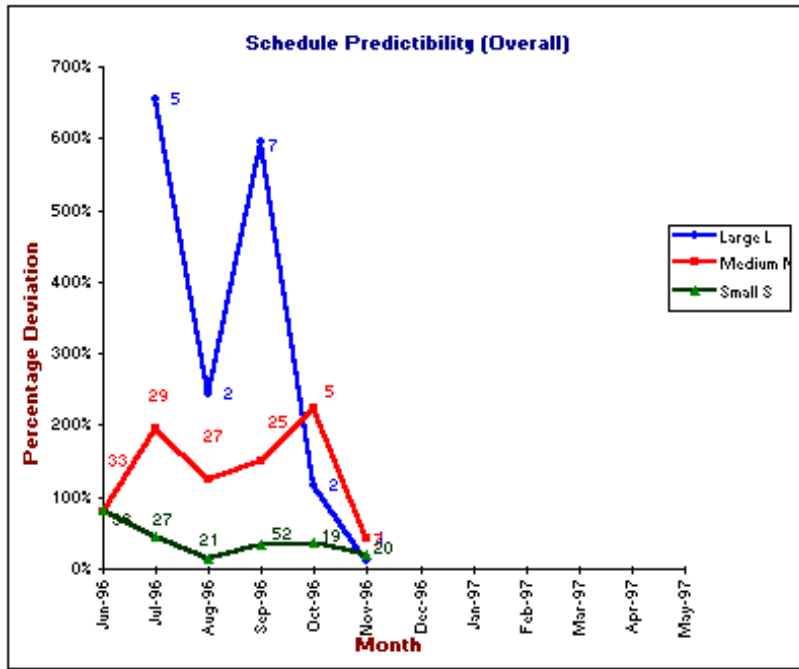
Month	Large L	Medium M	Small S
Jun-96		79.54%	82.00%
Jul-96	654.57%	196.96%	45.00%
Aug-96	243.55%	125.79%	14.00%
Sep-96	595.39%	149.08%	34.00%
Oct-96	117.24%	225.00%	36.00%
Nov-96	11.11%	43.69%	20.00%
Dec-96			
Dec-96			
Jan-97			
Feb-97			
Mar-97			
Apr-97			
May-97			

Data for illustrative purpose only

Measurement Approach

Software Measurement Process ISO 15939 (draft)

USER FEEDBACK

Technical and Management Processes

ANALYSIS RESULTS

INFORMATION NEEDS

Core Measurement Process

Establish Capability

Plan

Perform

MEAS-UREMENT PLAN

Experience Base

ANALYSIS RESULTS AND PERFORMANCE MEASURES

IMPROVEMENT ACTIONS

Evaluate

Scope of Standard

Summary

IT cannot do this alone

- **requires business goals**
- **requires a customer life-cycle perspective**
- **business and IT managers must agree on the priority areas to which IT contributes**

Alignment of measures is key

Action must result from the information

Real improvement can only be gauged by multiple measures

For more information

SEI and SEMA

- **http://www.sei.cmu.edu**

- **http://www.sei.cmu.edu/sema**

Performance Measurement

- **http://www.itpolicy.gsa.gov/mkm/pathways/pp03link.htm**

- **http://www.dtic.mil/c3i/c3ia/itprmhome.html**